

SCIENCE AND TECHNOLOGY

Providing New Options to the Warfighter

Headquarters, U.S. Army Materiel Command (AMC)

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Technology generation and application, one of the U.S. Army Materiel Command's three core competencies, is critical to Army modernization and provides the soldier with a winning edge on the battlefield. The rapidly accelerating pace of technological change will continue to offer significant enhancements for greater survivability, lethality, deployability and versatility of Army forces. The purpose of this newsletter is to keep the commanders-in-chief and their staffs informed of specific technological efforts pertinent to their missions. The newsletter is published quarterly. This issue of Science and Technology focuses on:

MOBILITY / SURVIVABILITY AND FORCE PROTECTION / SUSTAINABILITY AND REDUCED LOGISTICS FOOTPRINT AND OTHER TECHNOLOGY INITIATIVES

Sustainability and Reduced Logistics Footprint. Thermal Curing Blanket System (TCBS): The Army's ManTech Program has developed and demonstrated a prototype thermal curing blanket system (TCBS) for this repair of the H-60 main rotor blade that optimizes the curing process and eliminates fallout/rejections during rotor blade repair. The prototype TCBS consists of three blanket segments, feedback sensors, three controllers, and the connecting cabling. Each blanket segment contains thirty 2 inch by 18 inch heating elements. The control system uses a proportional, integral, derivative control algorithm. The TCBS is capable of controlling the temperature across the repair areas to within + 10oF over the total blade length of 22 feet during the 90-minute cure cycle. The TCBS is controlled by a program that will also facilitate transition to other composite repair applications.



Developer: U.S. Army Aviation and Missile Command, Aviation and Missile Research, Development, and Engineering Center, Redstone Arsenal, AL 35898, Point of Contact: Warren Alford

Sustainability and Reduced Logistics Footprint *(additional information)*

Thermal Curing Blanket System (TCBS):

Background:

The Department of Defense (DoD) relies on the Black Hawk (UH-60A, Army) and Sea Hawk (SH-60B, Navy) helicopters for many of its strategic defense operations in the world theater. Timely and cost effective sustainment of these helicopters is critical to the responsiveness of the services. Approximately twenty percent of the H-60 main rotor blades arriving at the Corpus Christi Army Depot (CCAD) require replacement of the deicing mat sheath assembly. . This repair is one of the most complex and is often referred to as a Category 3 repair (as denoted in the Depot Maintenance Work Requirement).



Problem:

Corpus Christi Army Depot (CCAD) is responsible for making repairs to the UH-60 Black Hawk rotor blade that includes replacement of the leading edge deicing sheath. This replacement process involves repairing a composite rotor blade leading edge. To insure a good bond, an even temperature must be maintained across the total span of the blade. The optimum cure temperature is $250^{\circ}\text{F} + 10$ degrees Fahrenheit ($^{\circ}\text{F}$). The current blanket system used for curing provides a constant heating rate. Several materials are used in the blade construction and the different thermal properties of these materials cause a temperature variation of over 40°F across the blade surface. This temperature

variation leads to incorrect curing during the repair process and results in high scrap and rework rates for the repair process.

Objective:

The objective of this Army Manufacturing Technology (ManTech) Program effort was to develop and demonstrate a thermal curing blanket system that could be used with either a hot bond controller or integrated controls of an autoclave for the Category 3 repair of the H-60 main rotor blade. The blanket temperature control technology would be required to hold a temperature tolerance of + 10oF from the respective set point at any point on the blanket and on the blade during the entire curing soak cycle of 90 minutes. This close temperature tolerance differential must be held over a blade length of 22 feet. Manual intervention of the controls and/or set points should not be required.

Accomplishment:



Blade Bagged in TCBS

The Army's ManTech Program has developed and demonstrated a prototype thermal curing blanket system (TCBS) for this repair of the H-60 main rotor blade that optimizes the curing process and eliminates fallout/rejections during rotor blade repair. The prototype TCBS consists of three blanket segments, feedback sensors, three controllers, and the connecting cabling. Each blanket segment contains thirty 2 inch by 18 inch heating elements. The control system uses a proportional, integral, derivative control algorithm. The TCBS is capable of controlling the temperature across the

repair areas to within + 10oF over the total blade length of 22 feet during the 90-minute cure cycle. The TCBS is controlled by the existing CCAD autoclave control program which will also facilitate the transition to other composite repair applications.

Funding:

Total FY 97 through FY 99 = \$ 575K



Bagged Blade in CCAD Autoclave

Benefits:

Implementation of the TCBS is projected to result in a cost savings of \$ 2.5M per year at CCAD.

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